Professional Development Course
Course Title: Iowa Core Mathematics: Teaching Fractions in Grades 3-6

Course Description:
This professional development is the beginning of on-going work to fully implement the Number and Operations – Fractions domain of *Iowa Core Mathematics*. Participants will study *Iowa Core Mathematics* and the book *Extending Children's Mathematics Fraction and Decimals, Innovations in Cognitively Guided Instruction,* to deepen their pedagogical content knowledge for teaching fractions in grades 3 through 6. This course will focus on:

- Understanding the content and instructional shifts for teaching fractions resulting from adoption of *Iowa Core Mathematics*.
- Building students' understanding of fractions through solving and discussing word problems.
- Understanding the progression of children's strategies for solving fraction problems.
- Designing instruction to integrate algebra into the teaching and learning fractions.

Course Objectives:
Participants will (1) explain the content and instructional shifts for teaching fractions resulting from adoption of *Iowa Core Mathematics*, (2) identify children's strategies for solving fraction problems, (3) implement research-based instructional strategies to build students' understanding of fractions and algebra, and (4) reflect on classroom implications.

Primary Participant Resources:
1. *Iowa Core Mathematics* (November 2010). (http://www.educateiowa.gov/index.php?option=com_content&view=article&id=2243&Itemid=4341)
2. Empson, S. B. and Levi, L. (2011). *Extending Children's Mathematics: Fractions & Decimals, Innovations in Cognitively Guided Instruction.* Portsmouth, NH: Heinemann.
3. Iowa Core Mathematics K-5 Content and Practice Shifts
4. Common Core Standards Writing Team. (2013, September 19). Progressions for the Common Core State Standards in Mathematics (draft). Number and Operations—Fractions, 3–5. Tucson, AZ: Institute for Mathematics and Education, University of Arizona. (http://ime.math.arizona.edu/progressions)

Additional Instructor Resources (optional):
5. Developing Effective Fractions Instruction for Kindergarten through 8th Grade. (Sept. 2010) IES Practice Guide by U.S. Department of Education.
6. NCTM Essential Understanding Series Rational Numbers for Teaching Mathematics in Grades 3-5
7. Fennell, Francis. *Fractions – Let's get this started!* Research Into Practice Mathematics.

IMAP Integrating Mathematics and Pedagogy: Searchable Collections of Children's Mathematical Thinking Video Clips and Facilitator's Guide (@2012 by Pearson) includes many video clips on fractions. If you have access to this resource, you may want to integrate some video clips throughout the ten sessions to illustrate student thinking about fractions.

Course Outline:
This schedule is based on ten 3-hour sessions for a total of 30 hours. Two-week intervals between sessions allows for completion of implementation assignments. Thirty hours is the minimal amount of time teachers need to complete this course. Using the 30-hour schedule limits the discussion time for each session and limits the time teachers have to internalize the content. If possible, the developers of this course recommend you extend the amount of time spent on each session or add sessions. Also note this course does not address decimals, Chapter 7 of *Extending Children's Mathematics*.

Session 3 hours	In-class Activities	Iowa Core Mathematics & K-5 Content and Instructional Shifts	Assignments
Prior to session 1 email Handout 1: "Iowa Core Mathematics Fraction Standards" and give the following assignment: Read "Iowa Core Mathematics Fraction Standards" (attached) and highlight standards or phrases indicating an approach different from typical practice. Take notes on what you find interesting, unique, challenging, and troublesome. Be prepared to discuss your thoughts.			
1	**Chapter 1** 1. Introduction to Class 2. Introduction to Content and Practice Shifts for Fraction Instruction 3. Common Student Misconceptions 4. Brownie Problem 5. Multiplication and Division Problem Types 6. Assignment	Iowa Core Mathematics: • 3.NF.1-3 • 4.NF.1-7 • 5.NF.1-5 • 6.NS.1 K-5 Content and Instructional Shifts: • Meaning of Fractions • Fraction Computation	• Read Foreword (pp. xi-xiv), Introduction (pp. xvii –xxvi) and Chapter 1 (pp. 2-31) • Write out answers to the discussion questions. • Implementation Assignment 1: Brownie problem
2	**Chapter 2** 1. Analyze Student Work from Implementation Assignment 1 2. Equal Sharing Problems and Iowa Core Mathematics 3. Instructional Guidelines for Equal Sharing Problems 4. Assignment	Iowa Core Mathematics: • 3.NF.1 • 4.NF.4a • 5.NF.3	• Read Chapter 1 (pp. 32-35) and Chapter 2 (pp. 36-46) • Read "Iowa Core Mathematics Content and Practice Shifts Grades K-5", the first three shifts under "The Meaning of Fractions" (pp. 9-11) • Implementation Assignment 2: Equal Sharing Problem
3	**Chapter 3** 1. Analyze Content Shifts Document 2. Analyze Student Work from Implementation Assignment 2 3. Multiple Groups Problems 4. Strategies for Multiple Groups Problems 5. Assignment	Iowa Core Mathematics: • 2.MD.6, 2.MD.9 • 3.MD.1-2, 3.MD.4 • 4.MD.1-5a • 5.MD.2 • 6.G.1-2 K-5 Content and Instructional Shifts: • Meaning of Fractions: Shifts 1-3	• Read Chapter 3 (pp. 48-68) • Write out answer to the discussion question. • Implementation Assignment 3: Ribbon or Walking Problem

Session 3 hours	In-class Activities	Iowa Core Mathematics & K-5 Content and Instructional Shifts	Assignments
4	**Chapter 4** 1. Analyze Student Work from Implementation Assignment 3 2. Multiple Groups Problems and Iowa Core Mathematics 3. Introduction to Relational Thinking 4. Instructional Guidelines for Multiple Groups Problems 5. Assignment	Iowa Core Mathematics: • 4.NF.3abc • 4.NF.4abc • 5.NF.7 • 6.NS.1	• Read Chapter 3 (pp. 65-71) and Chapter 4 (pp. 72-91) • Implementation Assignment 4: Multiple Groups Problem
5	**Chapter 5** 1. Analyze Student Work from Implementation Assignment 4 2. Properties of Operations 3. Making Relational Thinking Explicit 4. Assignment	Iowa Core Mathematics: • 1.OA.3, 3.OA.5, 3.OA.7 • 1.NBT.4, 1.NBT.6, 2.NBT.5-7, 3.NBT.2-3, 4.NBT.5-6, 5.NBT.6-7 • 4.NF.3 • 4.NF.4b, • 5.NF.4a K-5 Content and Instructional Shifts: • Properties of Operations	• Read Chapter 5 (pp. 92-113) • Read "Iowa Core Mathematics Content and Practice Shifts Grades K-5", the shifts under "Properties of Operations" (pp. 3-4) • Implementation Assignment 5: Multiple Groups Problem and Relational Thinking
6	**Chapter 6** 1. Analyze Student Work from Implementation Assignment 5 2. Fraction Equivalence 3. Fraction Order 4. Problems for Fraction Equivalence and Order 5. Instructional Guidelines for Fraction Equivalence and Order 6. Assignment	Iowa Core Mathematics: • 3.NF.3abcd • 4.NF.1-2 K-5 Content and Instructional Shifts: • Meaning of Fractions: Shifts 4-6	• Read Chapter 6 (pp. 114-147) • Read "Iowa Core Mathematics Content and Practice Shifts Grades K-5", the last three shifts under "The Meaning of Fractions" (pp. 11-12) • Implementation Assignment 6: Fraction Equivalence and Ordering Problems
7	**Chapter 8** 1. Analyze Student Work from Implementation Assignment 6 2. Addition and Subtraction of Fractions 3. Multiplication of Fractions 4. Division of Fractions 5. Assignment	Iowa Core Mathematics: • 4.NF.3-4 • 5.NF.1-7 • 6.NS.1	• Read Chapter 8 (pp. 178-208) • Write out answer to the discussion question.

Session 3 hours	In-class Activities	Iowa Core Mathematics & K-5 Content and Instructional Shifts	Assignments
8	**Chapters 8 and 9** 1. Addition and Subtraction Word Problems for Fractions 2. Multiplication and Division of Fractions 3. Instructional Guidelines for Fraction Computation 4. Assignment	Iowa Core Mathematics: • 4.NF.3-4 • 5.NF.4-7 • 6.NS.1 K-5 Content and Instructional Shifts: • Fraction Computation	• Read Chapter 9 (pp. 224-232) • Read "Iowa Core Mathematics Content and Practice Shifts Grades K-5", the shifts under "Fraction Computation" (pp. 12-15) • Implementation Assignment 7: Fraction Computation Problem • Bring a laptop to Session 9
9	**Standards for Mathematical Practice** 1. Analyze Student Work from Implementation Assignment 7 2. Content and Practice Shifts for Fraction Computation 3. Standards for Mathematical Practice 4. Assessment 5. Assignment	Iowa Core Mathematics: • Standards for Mathematical Practice K-5 Content and Instructional Shifts: • Fraction Computation	• Read "Progressions for the Common Core State Standards in Mathematics (draft). Number and Operations—Fractions, 3–5" • Bring your textbook and a laptop to Session 10
10	**Plan for Instruction** 1. Discuss the Fraction Progressions Document 2. Analyze Textbook Unit(s) on Fractions 3. Create a plan for Teaching Fractions with Understanding	Iowa Core Mathematics: • 3.NF.A.1-3 • 4.NF.A.1-2 and 4.NF.B.3-4 • 5.NF.A.1-2 and 5.NF.B.3-7 • 6.NS.A.1	